

2.14 Stormwater

2.14.1 General

The Design-Builder shall perform all Work necessary to design, document, and construct the stormwater drainage system for the Project. At a minimum, elements of Work shall include the following:

- Prepare a preliminary, a final, and an as built Hydraulic Report for the constructed Phase 2 Work at each Culvert Site in accordance with the WSDOT *Hydraulics Manual* and the WSDOT *Highway Runoff Manual*.
- Prepare individual BMP Maintenance Plans for each stormwater treatment facility constructed as part of the Phase 2 Work.
- Design and construct pavement drainage systems for both the permanent Project facilities and the temporary construction conditions.
- Prepare a Temporary Erosion and Sediment Control (TESC) Plan and implement TESC measures for the Project in accordance with the WSDOT *Temporary Erosion and Sediment Control Manual*. The TESC Plan shall include temporary drainage included for construction staging.
- Design and construct runoff treatment BMPs as required to meet the Mandatory Standards and the permit commitments for the Phase 2 Work.
- Design and construct stormwater flow control BMPs as required to meet the Mandatory Standards and the permit commitments for each Culvert Site.
- Protecting, maintaining, extending, or replacing existing culverts, storm sewer, and associated drainage structures to maintain the existing on-site flows and off-site flows that pass through each Culvert Site, including those that are impacted by the Work, to meet the Mandatory Standards and the requirements of this Section.
- Protecting the existing stormwater drainage system.
- Replacing, relocating, and maintaining existing subsurface drainage systems.
- Host task force and other meetings, as required, to coordinate the design with WSDOT Headquarters (HQ) and Region hydraulics, maintenance, landscape architect, and environmental staff, the WSDOT Engineer, and Local Agency staff.

The stormwater drainage system is defined as ~~all of~~ the stormwater and hydraulic structures, facilities, elements, BMPs, and features that are listed or referred to in the WSDOT *Hydraulics Manual* and WSDOT *Highway Runoff Manual* that exists on the Project or will be on the Project once the Project is completed. The stormwater drainage system may deal with on-site flows or off-site flows or both. Off-site flows may be from different sources including (but not

limited to) natural drainage courses consisting of natural seeps and springs, fish bearing streams, non-fish bearing streams, or both. Stormwater drainage system designs shall meet the requirements of this Section, and all Governmental Approvals. The Design-Builder shall convey runoff from flows originating from off-site and cross-drainage in a way that separates them from WSDOT stormwater BMPs. All stormwater drainage systems shall be designed using the methods described in this Section.

2.14.2 *Mandatory Standards*

The following is a list of Mandatory Standards that shall be followed for all design and construction related to this Section as referenced in TR Section 2.2, *Mandatory Standards*.

If the requirements of a Mandatory Standard, programmatic agreement, or permit issued for the Project conflict, then the provisions within the Project-specific permit shall take precedence.

1. Special Provisions (Appendix 4)
2. Standard Specifications M 41-10 (Appendix 4)
3. WSDOT *Highway Runoff Manual* M 31-16 (Appendix 4)
4. WSDOT *Hydraulics Manual* M 23-03 (Appendix 4)
5. WSDOT *Temporary Erosion and Sediment Control Manual* M 31-09 (Appendix 4)
6. WSDOT *Geotechnical Design Manual* (Appendix 4)
7. WSDOT *Design Manual* M 22-01 (Appendix 4)
8. WSDOT *Bridge & Structures Office Design Memoranda* (Appendix 4)
9. WSDOT *Bridge Design Manual LRFD* M 23-50 (Appendix 4)
10. WSDOT *Standard Plans* M 21-01 (Appendix 4)
11. WSDOT *Maintenance Manual* M 51-01 (Appendix 4)
12. WSDOT *Plans Preparation Manual* M 22-31 (Appendix 4)
13. WSDOT *Construction Manual* M 41-01 (Appendix 4)
14. WSDOT *Materials Manual* M 46-01 (Appendix 4)
15. WSDOT *Qualified Products List* (QPL)
<https://www.wsdot.wa.gov/Business/MaterialsLab/QPL.htm>
16. WSDOT *Environmental Manual* M 31-11 (Appendix 4)
17. WSDOT *Guidance on Wildlife Habitat Structures in Wetland Mitigation Sites* (Appendix 4)

2.14.2.1 *Computer Software*

The list of approved primary computer software accepted by WSDOT for hydraulic and stormwater analysis, calculations, and for use on the Project is in the WSDOT *Hydraulics Manual* and WSDOT *Highway Runoff Manual*. Use of other computer software not listed or referred to in this Section shall require approval from the WSDOT Engineer.

- Approved Software:
 - MGSFlood continuous simulation hydrologic model Version 4.52 or higher for runoff treatment and flow control BMP designs in western Washington.
 - FHWA Hydraulic Toolbox
 - FHWA HY-8 Culvert Hydraulic Analysis Program
 - StormShed3G by Engenious Systems, Inc. - The Design-Builder may request substitution of StormShed3G by providing justifications listed in HM Figure 1-3 including footnotes 2 and 5. The substitution request must be approved prior to submitting conveyance calculations for consultation or review.

2.14.2.2 *Acceptable Design Reference Documents*

The WSDOT *Hydraulics Manual* and WSDOT *Highway Runoff Manual* are the primary hydraulic and stormwater design manuals.

The following documents are accepted by WSDOT for use in the design of the Project. If any conflicts occur in design criteria, the WSDOT *Hydraulics Manual* and WSDOT *Highway Runoff Manual* supersede the design reference documents listed below. The Design-Builder shall obtain the WSDOT Engineer's approval prior to use of other design reference documents.

- *FHWA HEC-14, FHWA Hydraulic Design of Energy Dissipaters for Culverts and Channels*
- *FHWA HEC-15, FHWA Design of Roadside Channels with Flexible Linings*
- *FHWA HEC-22 Urban Drainage Design Manual*
- *FHWA HDS 5, FHWA Hydraulic Design of Highway Culverts*
- *EM 1110-2-1601 U. S. Army Corps of Engineers, Hydraulic Design of Flood Control Channels EM 1110-2-1601*
- *NCHRP Report 568, Rip Rap Design Criteria, Recommended Specifications, and Quality Control*
- *WSDOE Stormwater Management Manual for Western Washington*

2.14.3 *Personnel Requirements Drainage Design Lead Engineer*

The Design-Builder shall designate a Drainage Design Lead Engineer. The stormwater drainage system design shall be prepared by, or under the direct supervision of, the Drainage Design Lead Engineer.

The Drainage Design Lead Engineer shall have a minimum of 10 years of experience in the design and construction of highway-related drainage elements, and a minimum of 2 years of specific WSDOT highway drainage design experience within the last 4 years. The Drainage Design Lead Engineer shall be a Licensed Professional Engineer in Washington State and shall be in responsible charge of the stormwater design. The Drainage Design Lead Engineer shall also be responsible for all drainage design revisions made throughout the duration of the Term.

The Drainage Design Lead Engineer and all staff who are involved in stormwater BMP design shall obtain certification for completing the WSDOT *Highway Runoff Manual* training course prior to beginning the stormwater design.

The Drainage Design Lead Engineer shall have direct design experience and current knowledge of designing and implementing low-impact development-type stormwater treatment techniques.

2.14.3.2 *Peer Reviewer*

The Peer Reviewer shall be selected by the Design-Builder to perform an independent expert review of the Final Hydraulic Report, as built Hydraulic Report, and all interim RFC drainage design packages. The Peer Reviewer shall also field verify the post construction As Built conditions of the stormwater drainage system. The Design-Builder shall submit to the WSDOT Engineer for comment all relevant documents required to establish to WSDOT's satisfaction that the Peer Review has the required experience and abilities. The Peer Reviewer shall be a Licensed Professional Engineer in Washington State, have WSDOT *Highway Runoff Manual* training certificate number, and have a minimum of 5 years total of design and construction experience in the areas of:

- Hydrologic and Hydraulic design specifically related to the collection and conveyance of roadway stormwater runoff and application of the WSDOT *Hydraulics Manual*.
- Stormwater design related to WSDOT projects and application of the WSDOT *Highway Runoff Manual*.
- Drainage Inspection

The Design-Builder shall submit the following information to WSDOT as they are developed for all Peer Reviews:

- A. Files sent to the Peer Reviewer for a Peer Review
- B. Files showing the Peer Reviewer's comments
- C. Files showing the responses and resolution of the Peer Reviewer's comments
- D. Letter or memorandum carrying the Peer Reviewer's Professional Engineer's stamp and signature stating the Peer Reviewer's comments have been resolved. The letter or memorandum shall list the documents reviewed and the completion dates of the review of each file by the Peer Reviewer.

The Design-Builder shall be responsible for addressing all comments made by the Peer Reviewer. The WSDOT Engineer shall be invited to attend all meetings between the Design-Builder and the Peer Reviewer. The Peer Reviewer's comments shall be resolved prior to building interim RFC drainage design packages. All letters or memorandums from the Peer Reviewer shall be included as an appendix in the Final Hydraulic Report and as built Hydraulic Report.

2.14.4 Design Requirements

2.14.4.1 Stormwater Design Criteria

The Design-Builder shall use the Mandatory Standards and the design criteria described in this Section and TR Section 2.15, *Roadside Restoration*, to develop the stormwater and hydraulic designs of the Project. If any of the design criteria are not achievable, the Design-Builder shall submit documentation of what cannot be achieved to the WSDOT Engineer. The Design-Builder shall provide an explanation of why it cannot be achieved, and a proposed alternative for Review and Comment.

The Design-Builder is encouraged to seek cost-effective solutions that provide equal or greater environmental benefits and reduced long-term maintenance. The final design shall maximize the innovative use of runoff treatment and flow control BMPs, low impact development type BMPs, reduction or reversion of existing impervious surfaces, and design features that lead to the increased infiltration of stormwater where practical and feasible. The Design-Builder's schedule shall show allowable Calendar Days for the WSDOT Engineer's Review and Comment as determined during the Phase 1 Services Period for each submittal listed in this Section.

The following table identifies the locations where stormwater retrofit BMPs will be provided and the type of BMP at each location.

Fish Passage and Diversion	Project Site ID Number	Stormwater Retrofit	BMP Type(s)
----------------------------	------------------------	---------------------	-------------

Inventory Site ID Number		Provided (Y/N)	
\$1\$	***\$2\$***	***\$3\$***	***\$4\$***

1

2 **2.14.4.2 Preliminary Hydraulic Reports**

3 The *Preliminary Hydraulic Report* developed during the Phase 1 Services Period
4 shall be the basis for finalizing drainage design submittals for RFC. If the Design-
5 Builder proposes final designs that are different from the stormwater treatment
6 systems identified in the Preliminary Hydraulic Report the Design-Builder shall
7 include a brief technical memo in the design submittal describing the design and
8 the justification for the change. The Design-Builder shall include all elements of
9 the design, and shall validate, refine, and detail the documentation to demonstrate
10 that the stormwater and hydraulic designs meets all requirements of this Section
11 and fulfills the environmental commitments for each Culvert Site.

12 **2.14.4.3 Collection and Conveyance Structures**

13 The Design-Builder shall be responsible for verifying the type, size, location, and
14 condition of existing collection and conveyance structures within the limits of
15 each Culvert Site. The conveyance structures include all the storm sewers,
16 culverts~~culverts~~, and cross-drains within the limits of each Culvert Site. The
17 Design-Builder shall inspect the existing condition, utilizing video surveys, so
18 that pipes can be reviewed for joint failures, cracks, and blockages within
19 structures and through the length of the conveyance and culvert pipes. The
20 Design-Builder shall be responsible for all dewatering and cleaning required to
21 complete this Work. The Design-Builder shall inspect the existing condition
22 surveys to determine if the condition of the pipe influences the storm drainage
23 system design. This information is critical to the design review and therefore
24 required as part of the preliminary design for submittals. If the WSDOT Engineer
25 concurs that the existing condition of conveyance structures requires repair or
26 replacement, the Design-Builder shall be entitled to a Change Order as and to the
27 extent provided in Section 6.9(D) (Changes Required by WSDOT) and Section
28 6.11 (Change Procedures) of this PDB Contract.

29 Where Shoulder widths are reduced on areas having gutter flow, the Design-
30 Builder shall be responsible for calculating the gutter flow and modifying the
31 collection and conveyance system to meet the WSDOT *Hydraulics Manual*
32 guidelines.

33 Pipe rehabilitation shall be designed in accordance with a method identified in the
34 WSDOT *Hydraulics Manual*. The pipe repair material shall have a 50-year
35 manufacturer's warranty for structural capacity based on the depth of cover. The
36 Design-Builder shall assume the host pipe does not contribute to the structural

capacity of the pipe repair. Pipe liners shall extend for the full length of the pipe. All voids outside of the liner along the length of the pipe shall be filled and each end of the liner shall have a smooth transition to the end of the pipe, without jagged edges. The Work shall comply with the conditions of the permits. The Design-Builder shall prepare an Environmental Compliance Plan to finish this Work. The installation, inspection, and testing shall follow the manufacturer's specifications and methods, and the Standard Specifications. When a new pipe is specified in the Design and Construction Requirements, the pipe liner is not considered a new pipe.

All conveyance system structures shall be located outside of the Traveled Way. Existing drainage structures shall be removed and relocated if they fall within the new Traveled Way. Adjusting the risers will be considered on a case-by-case basis.

The Design-Builder shall not place culverts, surface drainage structures, and pipelines, including provisions for future drainage facilities, in the reinforcement zone of reinforced earth, soil nail, and tie-back type walls.

If the final design proposes to use media filter drain BMPs upstream of a flow control BMP, the EOR shall demonstrate that the runoff would be collected and conveyed to the detention BMP properly for the full range of storm design recurrences specified in the WSDOT *Highway Runoff Manual*.

2.14.4.4 Wall Drains

Drainage shall be provided to all walls in accordance with the WSDOT *Geotechnical Design Manual*. Wall drainage systems shall be designed for ease of maintenance, shall not have elbows greater than 45 degrees, shall provide low-clogging minimal maintenance-type structures, and shall include removable clean-out covers and ports. Retaining walls shall be designed to prevent surface water from flowing down the face of the wall.

The internal wall drainage system (perforated pipe underdrain system) will be connected directly to a stormwater drainage system structure (catch basin, inlet, or manhole). If the Design-Builder is unable to directly connect to a structure, the wall drainage system may be day-lighted with appropriate erosion protection in a way that avoids backwater into the underdrain pipes. When connecting the perforated pipe to the main conveyance system, the invert of the perforated pipe shall be at or above the top of the pipe of the mainline conveyance system. The minimum diameter of underdrain pipes shall be 6 inches.

Discharge of groundwater to the surface drainage system may increase flow control and runoff treatment BMP sizes. If this occurs, the flow control and runoff treatment BMPs shall be sized appropriately to accommodate the groundwater discharge.

1 Placement of open “weep holes” through the exposed wall face acting as
2 underdrain outlets will not be allowed. Underdrain outlet ends shall be fitted with
3 flap-type anti-rodent entry fittings. Maintenance clean-out ports shall be provided
4 where underdrain pipes are connected to drainage pipes outside of a drainage
5 structure.

6 Underdrain systems shall not drain water from constructed stormwater treatment
7 wetlands or other treatment BMPs unless specified in the design of those
8 stormwater treatment BMPs.

9 Infiltration-type BMPs shall not be used on top of walls unless otherwise
10 approved by the WSDOT Engineer. Approved infiltration-type BMPs on the top
11 of walls may be integrated with the wall drainage system to provide the function
12 of a BMP underdrain.

13 **2.14.4.5 Storm Sewer and Non-Fish Passable Culverts**

14 The Design-Builder shall be responsible for inspection and maintenance of all
15 culverts and storm sewer pipes within the Project limits as described in TR
16 Section 2.29, *Maintenance During Construction*.

17 A culvert is a closed conduit under a roadway or embankment used to maintain
18 flow from a natural channel or a drainage ditch. A storm sewer is a closed conduit
19 under a roadway or embankment used to maintain flow from a closed conduit
20 system. See WSDOT *Hydraulics Manual* for examples of culverts and storm
21 sewers.

22 The Design-Builder shall retain, modify, and protect ends with headwalls, or
23 abandon the existing storm sewer and culverts to match revised roadway sections
24 in accordance with the Mandatory Standards.

25 The Design-Builder shall notify the WSDOT Engineer immediately if the
26 inspections identify actions that would violate the permits. In addition, the
27 Design-Builder shall develop and implement an acceptable plan to resolve the
28 violation.

29 The Design-Builder shall locate and determine the Work required to meet the
30 Mandatory Standards if the Project connects to or modifies existing culverts and
31 storm sewers in any way.

32 Storm sewers operated and maintained by others (e.g., city and county storm drain
33 systems) shall be protected, kept separate from the Project stormwater drainage
34 system, and maintained at their existing capacity and function.

35 **2.14.4.6 Infiltration**

36 The design of infiltration BMPs shall be in accordance with the WSDOT
37 *Highway Runoff Manual*. Any stormwater BMP that uses infiltration within a

floodplain requires a WSDOT *Highway Runoff Manual* deviation and would need to follow HRM Section 4-5.

If required as part of the Culvert Bundle Amendment, The Design-Builder shall perform supplemental infiltration capacity investigations, and when doing so these shall be performed per WSDOT *Highway Runoff Manual* Appendix 4D and as required in HRM sections for specific infiltration BMPs to meet the requirements of the Mandatory Standards. The Design-Builder's BMP designs that include infiltration shall be based on the recommendations of the Design-Builder's Geotechnical Group Manager based on methods in HRM Section 4-5 and Appendix 4D. If required as part of the Culvert Bundle Amendment, the Design-Builder shall continue reading and recording data from the piezometers for design purposes.

2.14.4.7 *Runoff Treatment and Flow Control*

Permanent highway flow control and runoff treatment BMPs shall be designed in accordance with the WSDOT *Highway Runoff Manual*.

If the use of emerging technologies and proprietary (vendor-supplied) runoff treatment BMPs and flow control devices are proposed by the Design-Builder, they shall be evaluated in accordance with Section 5-3.6 of the WSDOT *Highway Runoff Manual* and subject to WSDOT Maintenance review and approval. Appropriate documentation shall be submitted to the WSDOT Engineer for Review and Comment and all comments shall be resolved prior to emerging technology or proprietary runoff treatment BMPs being incorporated into the Project design.

The Design-Builder shall not use galvanized products on the stormwater drainage system including pipes, grates, control structures, ladder rungs, birdcages on top of overflow structures, and other hydraulic structures. Two coats of paint shall be applied when an aluminum pipe or pipe arch is in contact with cement concrete or Controlled Density Fill.

When compost is used in stormwater BMPs, the Design-Builder shall follow the compost type specified in the WSDOT *Highway Runoff Manual*.

Construction timing for permanent stormwater BMPs shall be coordinated with the various other construction activities, including but not limited to landscaping, and barrier installation, ***to be determined during the Phase 1 Services Period. Once installed, the Design-Builder shall not drive equipment over the area of the permanent stormwater BMP. *** [Note: This paragraph will be updated as part of the Project GMP Culvert Amendment.]

Tanks (circular pipes) shall not be used at any of the Culvert Sites. Vaults may be allowed with the review and approval of the WSDOT Engineer. The Design-

1 Builder shall demonstrate that there are no other viable options before vaults will
2 be approved.

3 Wall surfaces within drainage facilities shall be designed to be aesthetically
4 compatible or located at low visibility locations.

5 Stormwater management BMPs shall be equipped with necessary hydraulic
6 controls for ease of dewatering permanent wet pools as required for maintenance.
7 The Design-Builder shall submit maintenance access, pipe slope, drain systems,
8 and other provisions for maintenance to WSDOT for Review and Comment.

9 **2.14.4.8 Analysis of Existing Stormwater Drainage System**

10 For any structure, facility, element, BMP, or feature of the existing stormwater
11 drainage system that is impacted or modified by the Phase 2 Work, the Design-
12 Builder shall:

- 13 • Document the existing condition of the existing stormwater drainage
14 system that is impacted or modified by the Project at each Culvert Site.
- 15 • Perform and document that the appropriate hydrologic and hydraulic
16 design analysis for each impacted or modified drainage asset of the
17 stormwater drainage system is in accordance with this Section and the
18 WSDOT *Hydraulics Manual* and *Highway Runoff Manual*.
- 19 • Provide a downstream analysis for at least 0.25 miles downstream of each
20 discharge location from WSDOT ROW per the WSDOT *Hydraulics*
21 *Manual*. The Design-Builder shall provide a capacity analysis with
22 backup calculations showing the downstream conveyance has adequate
23 capacity to convey the project's flows in the post-development condition
24 based on the WSDOT *Hydraulics Manual*. When the downstream
25 conveyance system is under capacity, the Design-Builder shall upsize the
26 conveyance system to meet the requirements in the WSDOT *Hydraulics*
27 *Manual* or otherwise mitigate the increased flow at no additional cost to
28 WSDOT.
- 29 • Provide a sizing analysis of all impacted or modified existing stormwater
30 BMPs that show the appropriate pre-developed and post-developed
31 conditions to ensure at a minimum that the same amount of area has the
32 same or better level of runoff treatment, flow control, or both in
33 accordance with the WSDOT *Highway Runoff Manual*. The Design-
34 Builder shall also highlight any increases in flows from existing
35 stormwater BMPs as a result of the Project and provide solutions to
36 protect against downstream erosion.
- 37 • Document each design analysis in the Final Hydraulic Report and as built
38 Hydraulic Report.

The Project's impacts or modifications to the existing stormwater drainage system shall not increase the potential for erosion and flooding upstream or downstream of the Project.

The Project's impacts or modifications to the existing stormwater drainage system shall not decrease the amount and level of runoff treatment and flow control provided by existing BMPs.

The as built and survey information provided by WSDOT serve as the basis for capacity evaluation of the existing stormwater drainage system. If the capacity of an existing stormwater drainage system differs from the capacity determined by the as ~~built~~built and survey information provided by WSDOT, the responsibility for costs associated with the correction shall be as follows:

- Where the actual capacity meets or exceeds the capacity required for the completed Project, the Design-Builder shall document the actual conditions in the As Built Plans with no adjustment to the applicable Base Culvert Bundle Guaranteed Maximum Price.
- Where the actual capacity and the capacity of the existing stormwater drainage system as shown in the information provided by WSDOT is not sufficient for the completed Project, the Design-Builder shall replace the structure at the required capacity to meet the requirements of the Mandatory Standards with no additional compensation.
- Where the actual capacity does not provide the capacity required and the capacity was adequate based on information provided by WSDOT, the Design-Builder shall notify the WSDOT Engineer. If the WSDOT Engineer accepts the assessment and proposed action, the Design-Builder shall be entitled to a Change Order as and to the extent provided in Section 6.9(D) (Changes Required by WSDOT) and Section 6.11 (Change Procedures) of this PDB Contract.

2.14.4.9 *Backwater Analysis*

If any earthwork activity associated with the Work is within a Federal Emergency Management Agency (FEMA)-mapped 100-year floodplain, a backwater analysis shall be performed and documented in the Specialty Report showing changes in floodplain elevations and the locations where the Project creates a changed condition in the hydraulics of features that convey the 100-year floodwaters.

2.14.4.10 *Outfalls and Discharge Points*

All outfalls and discharge points shall be protected from erosion. Appropriate erosion control measures shall be designed in accordance with the Mandatory Standards.

2.14.4.11 Maintenance Access

All new stormwater BMPs, culverts, fish passable structures, and all other parts of the stormwater drainage system shall be situated and provided with separate access such that routine maintenance and inspections can be easily achieved. Catch basins, inlets, and manholes shall be located at the outer edges of Shoulders, in medians, or gore areas, where access by vector high pressure rodding and vacuum trucks can be easily achieved. Manholes, hydraulic control, and sedimentation structures located outside of the paved Shoulder area in grass medians or Shoulder areas shall be provided with a maintenance access road. Fish passable structures, culverts, storm sewer, and all other parts of the stormwater drainage system isolated from convenient maintenance and inspection access shall be provided with achievable maintenance and inspection access at one end

Stormwater treatment BMPs shall have maintenance access in accordance with the WSDOT *Highway Runoff Manual* and this Section. Hydraulic control structures such as weirs, orifices, valves, and gates that are used for the operation, monitoring, and maintenance of ponds and other treatment or flow control BMPs shall be provided with a maintenance access road. Maintenance access adjacent to the sedimentation pools of ponds shall include a working area suitable for the loading and maneuvering of sediment disposal equipment and trucks. When a Shoulder is used for maintenance purposes, the Shoulder shall be wide enough for maintenance activities, typically 15 feet. The Design-Builder shall consult with the WSDOT Engineer for concurrence of appropriate Shoulder widths.

Where stormwater BMPs are located outside of the Shoulder or median area; or where isolated by barriers, walls, or berms; maintenance access shall be provided for such routine work as monitoring, inspections, mowing, and changing of filter or compost media.

Maintenance access roads shall be designed to be compatible with maintenance equipment in accordance with the following table:

BMPs Type	Design Vehicle	Access Requirement
Open ponds	SU, SU with trailer, WB-40	Vector to clean outfall structure, Self-propelled crane (WB-40) with clam bucket to clean pond (this is a four-axle with two steering axles on the front and two rear driving axles on the rear). Dump truck with trailer for hauling spoils.
Media Filter Drain	SU, SU with trailer	Dump truck, trailer, and backhoe to change filter media. Truck and trailer with mower.
Biofiltration Swales	SU, SU with trailer	Truck and trailer with mower.

Maintenance access roads shall be designed in accordance with the WSDOT *Highway Runoff Manual*. Maintenance access roads shall be designed so that maintenance equipment can perform required maintenance without encroachment on the edge of pavement. A light use access road shall consist of a prepared subgrade in accordance with Section 2-06 of the Standard Specifications; shall be sloped and shaped for proper drainage or provided with underdrains; and shall include a layer of construction geotextile and 6-inch minimum thickness of crushed surfacing base course. Landscaped areas adjacent to maintenance access roads shall be designed and constructed to fit with the landscaping theme, using alternative surfacing reinforcement such as soil grids and grow-through paver blocks. Maintenance access designs shall be submitted to WSDOT for Review and Comment prior to being incorporated into the Project.

WSDOT stormwater BMPs shall be delineated per the Standard Plans.

2.14.4.12 Stormwater and Hydraulic Design Revisions During Construction

Calculations for revisions made during construction shall be incorporated into the As Built Hydraulic Report when construction is completed.

When new plan sheets or revised sheets are required as part of a construction revision, the revisions shall be made in accordance with TR Section 2.28, *Quality Management Plan*, and are subject to Review and Comment

2.14.4.13 Stormwater BMP Maintenance Plans

The Design-Builder shall prepare a stormwater BMP maintenance plan for each new or modified BMP using the BMP maintenance plan template in Appendix 4. The Design-Builder shall submit the BMP maintenance plans that reflect the As Built conditions to the WSDOT Engineer for Review and Comment.

Each separate BMP maintenance plan shall include:

- A vicinity map showing the location of the BMP using SR and Mileposts, stations and offsets, and longitude and latitude.
- A Site Information sheet that documents the facility type, agency responsible for maintenance, the design and construction job number, the title of the Hydraulic Report, plan preparation date, BMP description, space to include a feature number, and any remarks of special design features such as pond liners, maintenance valves, load limitations, venting requirements or any other special features.
- An enlarged aerial photograph shall be included showing the BMP and its vicinity.
- An established control point, survey benchmark within 100 feet of the BMP. The survey benchmark shall have the same vertical and horizontal data as included in the contract plans to the nearest hundredth of a foot.

- Guideposts showing the type of BMP in the field per the WSDOT *Highway Runoff Manual* (Section 5-4.3.7).
- Maintenance frequency as dictated in the WSDOT *Highway Runoff Manual* or NPDES permit.
- Maintenance procedures for the BMP. On the plan sheets, highlight the areas that need to be maintained, and describe the maintenance activity that need to be done in each highlighted area.
- Include a description of the BMP used and how it functions, special maintenance procedures, as well as a complete set of as-constructed drawings showing design details for each element of the feature. The complete set of drawings shall include all the plan sheets, cross-sections, and detail sheets for the BMP.
- Include landscaping plans for any runoff treatment facilities that include specific plants for their function.

In addition to the BMP maintenance plans the Design-Builder shall include a tabulation of quantities for new stormwater drainage system (e.g., manholes, catch basins, linear feet of storm drainpipe, stormwater BMP acres of pond site, linear feet fencing, etc.). Locations with approved deviations from the Mandatory Standards shall be noted in this tabulation with the deviated condition included (e.g., high velocity pipe, low velocity pipe, low freeboard, etc.).

After incorporating the WSDOT Engineer's review comments, the Design-Builder shall provide the BMP maintenance plans in a searchable PDF.

2.14.5 Construction Requirements

2.14.5.1 Protection and Restoration of Sensitive Resource Areas

~~All of~~ All the Design-Builder's staff shall have environmental training in accordance with TR Section 2.8, *Environmental*, and shall be aware that no access or impacts are permitted beyond the High Visibility Fencing (HVF). Where infiltration is possible, pipe outfalls to natural waterways shall be completed using infiltration trenches with over-topping level spreader designs for a more natural dispersion-type discharge. Where infiltration is not possible, pipe discharges shall be armored against erosion using bioengineering techniques. All temporary Work areas for pipe or ditch Work shall be graded and vegetation restored to previous existing conditions.

2.14.5.2 Maintenance of Existing and New Stormwater Drainage Facilities

The Design-Builder shall be responsible for annual inspection, and maintenance as required by WSDOT's National Pollutant Discharge Elimination System (NPDES) permit, within the maintenance responsibility limits described in TR

Section 2.29, *Maintenance During Construction*. The Design-Builder shall coordinate the initial inspection with the WSDOT Engineer to determine the condition of the stormwater system. The Design-Builder shall restore catch basins and BMPs to the condition determined during the initial inspection at Project closeout. Maintenance of drainage facilities shall include:

- Catch basins: Annually inspect and correct deficiencies as applicable within 6 months from the date the deficiency was identified.
- BMPs: Annually inspect and correct deficiencies as applicable within 1 year from the date the deficiency was identified.
- Clean catch basins, conveyance systems, culverts, and stormwater BMPs, such as ponds, using vacuor trucks and/or other means.
- Proper handling and disposal of solids and liquids removed from catch basins and stormwater BMPs.
- Document all inspections and corrections and provide documentation to the WSDOT Engineer upon Project closeout.

2.14.5.3 *Utilities*

The stormwater design shall accommodate existing Utilities.

2.14.5.4 *Catch Basins and Inlets Installation*

All catch basins and inlet openings shall be installed flush with the face of the curbs or barriers.

2.14.5.5 *Best Management Practice Sediment Depth Markers*

The Design-Builder shall coordinate with the WSDOT Engineer for the locations of the BMP sediment depth markers to be installed in stormwater BMPs per the WSDOT *Highway Runoff Manual*.

2.14.5.6 *Temporary Erosion and Sediment/Pollution Control*

TESC and SPCC plans, and narratives shall be prepared and implemented in accordance with TR Section 2.8, *Environmental*, the WSDOT *Temporary Erosion and Sediment Control Manual*, Division 8 of the Standard Specifications, Applicable Law, and the permits. Runoff from construction areas shall be collected, treated, and discharged consistently with the WSDOT *Temporary Erosion and Sediment Control Manual* and permits.

2.14.5.7 *Abandonment and Removal of Existing Drainage Structures*

Abandonment or removal of existing drainage structures and pipes shall be in accordance with Divisions 2 and 7 of the Standard Specifications. Any existing pipe or other structure, which will be abandoned and will remain under any

pavement, shall be filled using methods and materials that ensure the pipe or structure is completely filled in a supported, non-void condition. The Design-Builder shall include the abandonment details, including any abandon-in-place filling methods and materials, with the drainage structure and pipe shop drawings.

The following culverts shall be filled and abandoned:

To be determined during the Phase 1 Services Period [Note: This paragraph will be updated as part of the Project Implementation Amendment.]

2.14.6 Submittals

2.14.6.1 General

- Submittals shall be complete with associated engineering documentation and backup calculations sufficient to verify that the design meets the design requirements in this Section and the Mandatory Standards, specifications, permits, and applicable agreements. The Design-Builder shall provide all submittals in searchable PDF format.

2.14.6.2 Design Plans

The Design-Builder shall prepare plan sheets for the Project in accordance with TR Section 2.28, *Quality Management Plan*, WSDOT *Plans Preparation Manual*, and the Standard Specifications.

In addition to the items listed in the WSDOT *Plans Preparation Manual*, the Plans shall show all Sensitive Areas, the stream and wetland ordinary high water elevation contours, and FEMA flood level contours, that are hydraulically connected to stormwater drainage systems impacted or modified by the Project, fish passable structures, or stream restoration sites.

2.14.6.3 Shop Drawings

Refer to TR Section 2.28, *Quality Management Plan*, for all shop drawing submittals for drainage structures and pipe elements.

2.14.6.4 Design Calculations

The Design-Builder shall complete all calculations necessary for the design of the Work including those design requirements listed in this Section. The Design-Builder shall prepare calculations in accordance with the Mandatory Standards to support the stormwater and hydraulic designs shown in the Preliminary Hydraulic Report, Final Hydraulic Report, as built Hydraulic Report, interim RFC drainage design packages, and in the plans. The associated set of design calculations shall be submitted with each set of Drainage Plans submitted in accordance with TR Section 2.28, *Quality Management Plan*.

The calculations shall include, at a minimum, the following items:

- Index Sheets – The Design-Builder shall number all calculation sheets and prepare an index for the Project by subject with the corresponding sheet numbers. The Design-Builder shall list the name and number of the Project, State Route (SR) number, designer/checker initials, date (month, day, and year), and supervisor's initials.
- Design decision summaries.
- Narrative – The Design-Builder shall include a narrative that describes the approach taken and the order of the calculations, including sections on the hydraulics and hydrology methodologies used (appropriateness and accuracy requirements), design decisions made, and conclusions and summaries of the calculations results in both narrative and table formats. The calculations shall include electronic copies of the input and output from the supporting computer programs (made to fit on an 8.5 by 11-inch sheet size), spreadsheets, hand calculations, exhibits, and sketches. The calculations shall be in a logical order, technically clear, and cross-referenced to correspond directly with drainage structure and basin numbering on the drainage plans, maps, and exhibits for ease of reference.
- Drainage maps showing the existing and proposed stormwater drainage systems and other hydrologic features that are impacted by the Phase 2 Work, drainage basins, sub-basins, Threshold Discharge Areas (TDAs), existing and final conveyance and storm sewer structures, flow direction arrows, fish passage facilities, numbering system, and any other features necessary to support and clarify the design calculations. The drainage maps shall also show all geotechnical and Sensitive Areas, streams and wetlands with buffer boundaries, riparian zones, the ordinary high water and FEMA flood level contours, aquifer and wellhead protection zones, sanitary drain fields, and major Utilities that will impact the drainage design. The drainage design drawings and maps shall be made to fit on an 11 by 17-inch sheet size.
- Electronic copies of the input and output from the supporting computer programs, spreadsheets, and hand calculations.
- Other exhibits to provide details necessary to clarify and support the calculations.
- Technical Specifications necessary for construction.

2.14.6.5 *Final Hydraulic Report*

The Design-Builder shall assemble the Final Hydraulic Report for each Culvert Site to reflect the final hydraulic design as it was Released for Construction (RFC). The Final Hydraulic Report shall be submitted with the Final Drainage Design Plans. All supplemental hydraulic designs shall include the Drainage

1 Design Lead Engineer's stamp and WSDOT *Highway Runoff Manual* training
2 certificate number.

3 The Final Hydraulic Report for each Culvert Site shall be prepared by, or under
4 the direct supervision of, the Drainage Design Lead Engineer to reflect the final
5 hydraulic design as it was RFC. The Final Hydraulic Report for each Project shall
6 be stamped and signed by the Drainage Design Lead Engineer. The Final
7 Hydraulic Report shall be in accordance with the WSDOT *Hydraulics Manual*
8 and WSDOT *Highway Runoff Manual*. The Final Hydraulic Report shall be
9 submitted with the Final Drainage Design Plans within 60 days of completing the
10 Project drainage and stormwater system RFC. The Final Hydraulic Report shall
11 follow the guidance, outline, and format as shown in Section 1-3 of the WSDOT
12 *Hydraulics Manual*.

13 All drainage drawing Submittals made during construction shall include a
14 supplemental hydraulic design attachment to support WSDOT design review. The
15 supplements shall be specific to the changes as they relate to the design
16 documented in the Final Hydraulic Report; be easily readable as stand-alone
17 documents; show why the revision was made and how it affected the final design;
18 and include the revised drawings and exhibits, supporting calculations, and
19 revised summaries and tables.

20 After the creation of the Final Hydraulic Report, the Design-Builder shall
21 incorporate all supplements and create a single coherent and complete stand-alone
22 As Built Hydraulic Report. The As Built Hydraulic Report shall incorporate the
23 final As Built Plans including the updated report text, records of decision,
24 associated design criteria, drainage maps, Drainage Plans and profiles,
25 calculations, and details in accordance with Section 1-3 of the WSDOT
26 *Hydraulics Manual*. The As Built Hydraulic Report is subject to Review and
27 Comment. Before the As Built Hydraulic Report will be accepted, the Drainage
28 Design Lead Engineer shall field verify As Built conditions for their respective
29 areas of responsibility. The Design-Builder shall coordinate with the WSDOT
30 Engineer to invite the WSDOT Region Hydraulics Engineer, WSDOT Region
31 Maintenance representative, and the Peer Reviewer to all drainage As Built field
32 verification meetings. The list of drainage items field verified to meet As Built
33 conditions shall be signed by the Drainage Design Lead Engineer and Peer
34 Reviewer and included in the As Built Hydraulic Report.

35 The final Submittal shall include the As Built Hydraulic Report in searchable PDF
36 format, complete with all associated drawing files (MicroStation format),
37 electronic versions of spreadsheets, calculations, documents (Microsoft Word
38 format), and hydrologic/hydraulic models.

39 The As Built Hydraulic Report shall include the Drainage Design Lead Engineer's
40 stamp and WSDOT *Highway Runoff Manual* training certificate number.

1 The Design-Builder's schedule shall allow 30 Calendar Days for the WSDOT
2 Engineer's Review and Comment for each Hydraulic Report submittal.

3 **2.14.6.6** *Specialty Reports*

4 The Design-Builder shall prepare and submit Specialty Reports for any drainage or
5 stormwater work listed for specialty reports in the WSDOT *Hydraulics Manual*
6 Figure 1-1. Design methods and Specialty Report form and content shall be agreed
7 upon with the WSDOT Headquarters Hydraulic Section. Designs for Specialty
8 Reports shall conform to RFC submittal requirements and RFI Changes during
9 construction Requirements. Completed Specialty Reports shall be submitted with
10 the Final Hydraulic Report.

11 **2.14.6.7** *Minimum List of Submittals*

- 12 • Draft and Final Supplement to the Existing Stormwater Drainage System
13 Survey
- 14 • Draft and Final Downstream Analysis for Verification of Flow Control
15 Measures
- 16 • Drainage design calculations submitted with the corresponding drainage
17 design plans
- 18 • Hydraulic Report (various submittals during design development, complete
19 Final Hydraulic Report of the design as RFC, supplemental submittals
20 during construction, and complete As Built Hydraulic Report for the
21 Design File)
- 22 • Specialty Reports
- 23 • Stormwater BMP Maintenance Plans
- 24 • Shop drawings
- 25 • Technical Specifications
- 26 • Final submittal of electronic files including As Built Hydraulic Report in
27 searchable PDF format and all calculations, documents, and drawing files
- 28 • Final Submittal including *Drainage Maintenance Manual* in searchable
29 PDF format
- 30 • Design Plans
- 31 • Design Calculations
- 32 • Interim RFC Drainage Design Packages
- 33 • Stormwater and Hydraulic Design Revisions During Construction
- 34 • As built Hydraulic Report

1 **2.14.6.8 *Miscellaneous Submittals***

2 At the request of the WSDOT Engineer, the Design-Builder shall deliver to the
3 WSDOT Engineer Work-related submittals that do not fit in the previous
4 categories but are prepared in accordance with this Section.

5 **End of Section**